Marine Hydro Lift Flaps and Methods of Using Same

This application claims priority to and is a continuation-in-part of U.S. patent application Ser. No. 10/354,353, filed January 30, 2003, by Joseph A. Smith, entitled SMITH MOSES HYDRO LIFT FLAPS, which status is allowed and is incorporated herein in its entirety by reference.

FIELD OF THE INVENTION

This invention related to vessels, more specifically to an improved vessel construction with hydro lift flaps and method of using same to improve the performance of vessels.

BACKGROUND OF THE INVENTION

Through this specification, the background of the invention and the invention itself is described and claimed using terms that are well known in the filed of vessel design industry. Unless specifically indicated otherwise, the following definitions should be understood:

"Vessel" -- a craft, especially one larger than a rowboat, designed to navigate on or under water.

"Boat" – a vessel of any size including, but not limited to, vessels having considerable size for deep-water navigation such as an ocean ship or submarine.

"Prow"-- the forward part of a ship's hull, or the bow.

"Stem"-- the curved upright beam at the fore of a vessel into which the hull timbers are scarfed to form the prow.

"Stern"-- the after or rear end of a ship or other vessel, or of a boat; the part opposite to the stem, or prow.

Boat or vessel construction is not new. But people skilled in the art know that it has been always a challenge to have a vessel construction that can reduce vessel drag, allow a vessel to attain high speed at reduced fuel usage, and give local control of the vessel.

SUMMARY OF THE INVENTION

The above-noted challenge is taken by the present invention, which in one aspect is an improved boat construction. In a first embodiment of the invention, there is a hull having a bottom, a bow and a stern. Additionally, the improved boat construction of the invention includes a plurality of flaps, wherein each flap has a forward edge, a rear edge, and a body portion defined therebetween the forward edge and the rear edge. The body portion has an exterior surface and an opposite, interior surface.

Moreover, each flap is movably mounted to the bottom of the hull at the forward edge such that each flap can be moved between a first position and a second position that is apart from the first position. When a flap is in the first position, the angle, α, which is defined by the exterior surface of the bottom of the hull and the interior surface of the body portion of the flap, has a value substantially around zero such that the exterior surface of the body portion of the flap is substantially flat with the exterior surface of the bottom of the hull.

When a flap is in the second position, the body portion of the flap is apart from the bottom of the hull at an angle, α, with a non zero value, such that the flap is at least partially extended into the water flow to cause an upward force to be applied towards to the bottom of the hull. It is believed that when a flap is extended into the water flow at an acute angle, an upward force may be generated to partially lift the hull and thereby decrease the vessel drag.

In another aspect, the present invention relates to an apparatus for improving performance of a vessel, wherein the vessel has a hull having a bottom, a bow and a stern. In one embodiment, the apparatus has at least one flap, wherein the flap has a forward edge, a rear edge, and a body portion defined therebetween the forward edge and the rear edge, the body portion having an exterior surface and an opposite, interior surface, and is movably mounted to the bottom of the hull at the forward edge such that a flap can be moved between a first position and a second position apart from the first position. The apparatus also has means for moving the flap between the first position and the second position.

In yet another aspect, the present invention relates to a method for improving performance of a vessel, wherein the vessel has a hull having a bottom, a bow and a stern. In one embodiment, the method has the steps of providing at least one flap, wherein the flap has a forward edge, a rear edge, and a body portion defined therebetween the forward edge and the rear edge, the body portion having an exterior surface and an opposite, interior surface, and is movably mounted to the bottom of the hull at the forward edge such that a flap can be moved between a first position and a second position apart from the first position, and moving the flap between the first position and the second position, such that the flap is at least partially extended into the water flow to cause an upward force to be applied towards to the bottom of the hull to affect the performance of the vessel.

Other advantages and uses for the present invention will be more clearly understood by reference to the remainder of this document.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a perspective view of one embodiment of the present invention, where several flaps with extensions are shown mounted on a bottom of a vessel.

Figure 2 shows a side view of a flap according to one embodiment of the present invention.

Figure 3 shows the indicated section 3/3 identified in **Figure 2.**

DETAILED DESCRIPTION OF THE INVENTION

The present invention is more particularly described in the following examples that are intended as illustrative only since numerous modifications and variations therein will be apparent to those skilled in the art. As used in the specification and in the claims, "a" can mean one or more, depending upon the context in which it is used. Several embodiments are now described with reference to the Figs. 1-3, in which like numbers indicate like parts throughout the Figs. 1-3.

Referring first to FIGS. 1-3, in one aspect, the present invention relates to an improved boat construction. In a first embodiment of the improved boat construction of the invention, there is a hull 100 having a bottom 103, a bow 100a and a stern 100b. Additionally, the improved boat construction of the invention includes a plurality of flaps 101, wherein each flap 101 has a forward edge 101a, a rear edge 101b, and a body portion defined therebetween the forward edge 101a and the rear edge 101b. The body portion has an exterior surface 101c and an opposite, interior surface 101d.

Moreover, each flap 101 is movably mounted to the bottom 103 of the hull 100 at the forward edge 101a such that each flap 101 can be moved between a first position and a second position that is apart from the first position. When a flap 101 is in the first

position, the angle, α, which is defined by the exterior surface 103a of the bottom 103 of the hull 100 and the interior surface 101d of the body portion of the flap 101, has a value substantially around zero such that the exterior surface 101c of the body portion of the flap 101 is substantially flat with the exterior surface 103a of the bottom 103 of the hull 100. Thus, the first position can also be referred as a "closed position." As formed and shown in Fig. 1, in this embodiment, when a flap 101 is in the first position, the forward edge 101a of the flap 101 is located between the bow 100a and the stern 100b, and the rear edge 101b of the flap 101 is located between the forward edge 101a and the stern 100b.

When a flap 101 is in the second position, the body portion of the flap 101 is apart from the bottom 103 of the hull 100 at an angle, α, with a non zero value, such that the flap 101 is at least partially extended into the water flow to cause an upward force to be applied towards to the bottom 103 of the hull 100. Thus, the second position can also be referred as an "open position." The strength of the force applied to, or "felt" by, the bottom 103 of the hull 100 can be adjusted by varying the surface area of the body portion of the flap 101. Alternatively, the strength of the force can be adjusted by choosing a desired angle α. The angle α normally has a value in the range of 0 to 90 degrees. However, other values can also be chosen. It is believed that when a flap 101 is extended into the water flow at an acute angle, an upward force may be generated to partially lift the hull 100 and thereby decrease the vessel drag. It is further believed that when a flap 101 is extended into the water flow at an angle around 90 degrees, a braking force may be generated on the hull 100.

Furthermore, for each flap 101, there is means for moving a corresponding flap 101 between the first position and the second position. In one embodiment, for a flap 101, the moving means has at least one actuating mechanism mounted on the hull 100 and adapted for engaging the flap 101 at the rear edge 101a of the flap 101 and moving the flap 101 between the first position and the second position.

More specifically, as shown in Figs. 2 and 3, the actuating mechanism here is a mechanical one and includes an actuating piston 106, an actuating cylinder 107 that has an engagement portion 107a and is adapted for receiving the actuating piston 106 therein and allowing the actuating piston 106 to move axially between a first position and a second position, and an actuating cylinder boss 109 that is mounted on the interior surface 101d of the flap 101. A first pin 110 is utilized for engaging the actuating cylinder boss 109 and the engagement portion 107a of the actuating cylinder 107, and a second pin, or a hinge pin, 108 is utilized for engaging the actuating piston 106 through an arm end 105 to a cylinder mounting 118.

In operation, when the actuating piston 106 moves axially between the first position and the second position (not shown), the corresponding flap 101 moves accordingly. The motion of the flap 101, as shown in Fig. 2, is a partial rotation, A, around a direction represented by axis Y. As set forth above, the rotation A can have a rotational angle α in the range of 0 to 180 degrees.

Furthermore, for each flap 101, there is means for movably mounting the flap 101 to the bottom 103 of the hull 100. In one embodiment, the movably mounting means includes a hinge 122 that movably engages the flap 101 at the forward edge 101a to the bottom 103 of the hull 100.

Optionally, still referring to Figs. 1-3, further utilized are an extension portion 102 with a forward edge 102a and a rear edge 102b, and an extension guide 112 formed on the interior surface 101d of the body portion of the flap 101 and adapted for receiving the extension portion 102 therein and allowing the extension portion 102 to be moved along the interior surface 101d.

There is means for moving the extension portion 102 along the interior surface 101d. In one embodiment, the means for moving the extension portion 102 along the interior surface 101d can move the extension portion 102 along the interior surface 101d telescopically, i.e., allowing the extension portion 102 moves along the interior surface 101d, or direction B, as shown in Fig. 2, back and forth. The motion of the extension portion 102 can be independent from the motion A of the body portion of the flap 101. The motion of the extension portion 102 and the motion A of the body portion of the flap 101 can also be coordinated.

More specifically, as shown in Figs. 2 and 3, in one embodiment, the means for moving the extension portion 102 along the interior surface 101d includes an extension piston 113 and an extension cylinder 115. The extension piston 113 engages with the extension portion 102 and is adapted for moving the extension portion 102. The extension cylinder 115 is adapted for receiving the extension piston 113 therein and allowing the extension piston 113 to move axially between a first position and a second position so that the extension portion 102 can be moved by the extension piston 113 along the interior surface 101d accordingly. Furthermore, an extension cylinder mounting portion 117 is mounted to the interior surface 103b of the bottom 103 of the hull 100 and adapted for supporting extension cylinder 115.

Optionally, for each flap 101, its body portion defines a plurality of openings 104 along the forward edge 101a. These openings 104 can be utilized to mitigate vortexes and resultant drag. A housing 120 can be adapted to receive a corresponding flap 101 therein.

Furthermore, means for individually controlling each of the plurality of flaps 101 (not shown) can be utilized to control the flaps individually, or in one more groups of flaps, or all the flaps in coordination. Moreover, flap controlling means or operation devices can be powered by air, water, oil, electricity or other means. Activation device

numbers for each flap can be one or more. For the embodiment shown in Figs. 2 and 3, two similar activation mechanisms are utilized to activate a flap 101. Although a mechanical actuating mechanism is discloses here, other actuating mechanisms such as electrical, electronic, magnetic, wireless, or any combination of them, may also be utilized.

In operation, the flaps can be extended a small amount (minimally or no more than 20°), which may generate a lift force. If only one flap is activated, the lift force may lift the desired boat area. Thus, boat trim can be accomplished with no cargo movement necessary. Extension of all flaps minimally may lift the boat and decrease draft (boat projection into the water) and the decreased frontal area may result in less overall boat drag. This decreased boat drag may result in higher top boat speed and less boat fuel consumption. The flap extension 102 can be used to increase effective flap area and thus to increase lift force generated. Individual flap operation, on one side of the boat only, may generate drag on only one side of the boat, and can be used to steer the boat. The boat can be steered with no rudder deflection or use. Moreover, if all flaps are extended extensively, it is believed that the force generated may brake the boat and cause the boat to stop. In particular, in a configuration with two flaps, each is extended on one side to about 90°, may act as a brake and turn the vessel. It is further noted that in large vessels, more of the vessel's structure is above water line than below the water line. This structure results in overturning or capsizing moment on the turning vessel. This unstableness or leaning to the outside of turning may be counter acted by extending the flaps on the outside of turns.

The present invention can be practiced with one or more flaps. If more flaps are utilized to practice the present invention, the flaps can be substantially same or different.

In another aspect, the present invention relates to an apparatus for improving performance of a vessel, wherein the vessel has a hull 100 having a bottom 103, a bow 100a and a stern 100b. In one embodiment, the apparatus has at least one flap 101, wherein the flap 101 has a forward edge 101a, a rear edge 101b, and a body portion defined therebetween the forward edge 101a and the rear edge 101b, the body portion having an exterior surface 101c and an opposite, interior surface 101d, and is movably mounted to the bottom 103 of the hull 100 at the forward edge 101a such that each flap 101 can be moved between a first position and a second position apart from the first position. The apparatus also has means for moving the flap 101 between the first position and the second position..

In this embodiment, when the flap 101 is in the second position, the body portion of the flap 101 is apart from the bottom 103 of the hull 100 at an angle, α, and when the flap 101 is in the first position, the acute angle, α, has a value substantially around zero such that the exterior surface 101c of the body portion of the flap 101 is substantially flat with the exterior surface 103a of the bottom 103 of the hull 100.

The moving means has at least one actuating mechanism mounted on the hull 100 and adapted for engaging the flap 101 at the rear edge of the flap 101 and moving the flap 101 between the first position and the second position. The apparatus further has means for movably mounting the flap 101 to the bottom 103 of the hull 100. The apparatus further comprising an extension portion 102 with a forward edge 102a and a rear edge 102b, wherein the extension portion 102 is movable along the interior surface 101d.

In yet another aspect, the present invention relates to a method for improving performance of a vessel, wherein the vessel has a hull 100 having a bottom 103, a bow 100a and a stern 100b. In one embodiment, the method has the steps of providing at least one flap 101, wherein the flap 101 has a forward edge 101a, a rear edge 101b, and

a body portion defined therebetween the forward edge 101a and the rear edge 101b, the body portion having an exterior surface 101c and an opposite, interior surface 101d, and is movably mounted to the bottom 103 of the hull 100 at the forward edge 101a such that each flap 101 can be moved between a first position and a second position apart from the first position, and moving the flap 101 between the first position and the second position, such that the flap 101 is at least partially extended into the water flow to cause an upward force to be applied towards to the bottom 103 of the hull 100 to affect the performance of the vessel, wherein when the flap 101 is in the first position, the acute angle, α, has a value substantially around zero such that the exterior surface 101c of the body portion of the flap 101 is substantially flat with the exterior surface 103a of the bottom 103 of the hull 100, and when the flap 101 is in the second position, the body portion of the flap 101 is apart from the bottom 103 of the hull 100 at an angle, α.

From the description above, among other things, a number of advantages of an apparatus for improving performance of a vessel according to the present invention become evident:

(a) A flap installed on a vessel according to the present invention, when partially extended, may generate upward lift forces to the vessel. This decreased drag will project less frontal area and will enable the speed of the vessel to increase.

(b) The decreased drag caused by reduced effective frontal area may allow decreased fuel usage.

(c) One or more flaps can be utilized to raise the desired areas of a vessel and level an uneven vessel.

(d) The flaps on one side of a vessel can be utilized radically to cause excessive drag on that side of the vessel and thereby turning the vessel.

(e) All flaps can be extended radically to increase total drag for a vessel and act as brakes to limit the forward progress of a vessel.

While there has been shown several and alternate embodiments of the present invention, it is to be understood that certain changes can be made as would be know to one skilled in the art without departing from the underlying scope of the invention as is discussed and set forth above and below. Furthermore, the embodiments described above are only intended to illustrate the principles of the present invention and are not intended to limit the scope of the invention to the disclosed elements. Accordingly, the scope of the invention is to be determined by the claims below rather than being limited to the specifically described embodiment above.